

Towards a critical epidemiology approach for applied sexual health research

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ABSTRACT

Critical approaches may benefit epidemiological studies of sexual health. This paper proposes a critical approach, reconcilable with social epidemiological enquiry. Key aims of critical epidemiology for sexual health are identified, from which three criticisms of practice emerge: 1. Lack of attention to socio-cultural contexts; 2. Construction of 'risk' as residing in the individual; 3. Enactment of public health agendas which privilege and pathologise certain behaviours. These reflect and construct an apolitical understanding of population health. This paper proposes features of a critical epidemiology that represent a morally driven re-envisioning of the focus, analysis, and interpretation of epidemiological studies of sexual health.

INTRODUCTION

Applied sexual health research carries an overall interest in identifying the causes and distribution of adverse outcomes, alongside best means for preventing and addressing those outcomes. This research is often characterised by a biomedical focus on: sexually transmitted infections (STIs) and Human Immuno-Deficiency Virus (HIV), teenage pregnancy and unplanned pregnancy as 'adverse outcomes'; on the sexual 'risk behaviours' which precede these outcomes; and on the development and evaluation of sexual health interventions designed to ameliorate these outcomes (e.g. STI testing procedures, contraception advice and supply (CAS) services and sexual health information programmes).

This biomedical focus is supported by evidence that the global burden of HIV, of unplanned pregnancy, and of STIs remains high such that their control forms an integral part of global sustainable development goals (WHO, 2015). The evidence also presents a strong justification for applied research to focus on sexual behaviour as an 'intervening variable' in both STI acquisition and unplanned pregnancy. However, such an approach could be seen to cast sexual behaviour as pathological and pregnancy as morbid – operationalising public health interests and constructions which do not necessarily chime with those of lay populations. These concerns are linked to broader debates about public health regulation of individuals' bodies (Petersen and Lupton, 1996) and to critiques of how behavioural - and other - risk factors are now treated as diseases (Gillespie, 2012); both of which build on Foucault's concept of biopower (Petersen and Lupton, 1996).

The World Health Organisation's (WHO, 2010) definition of sexual health, while still biomedical, is positively framed and broader in focus. Certainly in the UK, both policy (DH, 2013) and research (Wellings and Johnson, 2013) have focused on broader aspects of sexual health (such as sexual function (Mitchell et al.) and the social determinants of sexual health (DH, 2013)). These positive and social aspects of sexual health, together with critiques of public health, invite us to revisit the scope and methodologies of sexual health epidemiology.

DEFINING THE INTERESTS AND NATURE OF SOCIAL EPIDEMIOLOGY

The WHO definition of epidemiology is ‘the study of the distribution and determinants of health-related states or events (including disease), and the application of this study to the control of diseases and other health problems’ (WHO, 2014). Social epidemiology is a sub-discipline distinguishable by its focus on the *social* determinants of health (Cohen et al., 2007)). At heart then, epidemiology is concerned with population rather than individual health, providing an evidence base for public health rather than clinical management. It can also be argued that epidemiology is methodologically defined – typically denoting a set of quantitative study designs and forms of analysis which are suited to the description and understanding of *population* health and the identification of risk factors (e.g. cross-sectional, longitudinal observational and case-control studies).

CRITICAL EPIDEMIOLOGY BEYOND SEXUAL HEALTH

This paper seeks to explore and set out how criticality (defined in the following section) might be realised within these conventional epidemiological study designs, and specifically in relation to applied sexual health research. Outside this remit, three authors have employed the term ‘critical epidemiology’ to argue for augmenting contemporary epidemiological study designs in the following ways: incorporation of qualitative methods *within* epidemiology (Hopper and Guttmacher, 1979); removal of individual cases as the primary unit of study (Robert and Smith, 2004); and stepping away from a focus on identifying individual-level risk factors (Wemrell et al., 2016).

Aside from these three authors the term ‘critical epidemiology’ has been predominantly used in the study of South American politics and ‘saude coletiva’ (‘social health’), leading to the persecution of associated academics (Breilh, 2008) (Waitzkin et al., 2001). Finally, Nancy Krieger (Krieger, 2000b) has used the term in her critiques of social epidemiology. Amongst other concerns, she challenges its adherence to a biomedical model and to the idea of the population as an aggregate of the individual. I.e. she notes that biomedical individualism focuses on what (Rose, 1992)

calls the 'cause of cases' rather than on 'the causes of incidence' which would address instead unequal distribution of disease across populations.

In addition, a large body of work has used mixed methods approaches to examine structural predictors of ill-health and/or to develop social interventions, without employing the term 'critical epidemiology'. The long-standing journal *Critical Public Health* is testament to this work, some of which may be deemed critical epidemiological in nature although the term is absent. However, this paper sets out a critical epidemiology which extends beyond the development and evaluation of social and structural interventions into the methods, analysis, interpretation and broader intentions of social epidemiological practice.

DEFINING KEY FEATURES OF CRITICALITY

Although the term 'critical epidemiology' therefore has some precedence, it has been poorly described and is therefore worthy of greater determination. Firstly, the word 'criticality' is used in the context of 'Critical Theory', developed originally by the Frankfurt School (Scambler, 2001). It has subsequently shaped branches of disciplines allied to health – particularly Critical Psychology and Critical Sociology.

The critical psychologist Murray (Murray, 2014) identifies two key features of critical theory as applied to specific disciplines:

1. Critical attention to structural concerns, power and norms, particularly as explanatory of both behaviour and health outcomes
2. An intention to bring about positive change in response to these critiques

In addition, the term 'criticality' is arguably used colloquially in academic circles to refer to:

3. Critical attention to the practices of research
4. Critical attention to the production of knowledge

These are proposed as four core features of criticality which might usefully be applied to sexual health epidemiological study. Importantly, they represent a particular *focus of interest and intent*, and are not methodologically defined. This indicates that criticality is not inherently incompatible with conventional quantitative epidemiology.

KEY AIMS FOR A CRITICAL EPIDEMIOLOGY FOR SEXUAL HEALTH

It is arguable that sexual health epidemiology is already sufficiently critical because - for each study - the methodology, analysis and interpretation of findings are carefully critiqued by researchers and their peers. However a truly 'critical epidemiology' would bring distinct intentions to:

1. Improve established *epidemiological practice* within applied sexual health research as a means of working towards a wider goal of social improvement grounded in understanding how social inequalities impact sexual (and other domains of) health
2. Improve that practice by first identifying and critiquing conventions of focus, methodology and interpretation - not only *within* individual studies but *across* social epidemiological practice as a whole

Murray (Murray, 2014) argues that morality is always present in the actions of any discipline, with the task of the critical professional being to notice, reflect upon and challenge that morality where necessary. These ideas recognise the moral issues extant in the notion that knowledge not only *reflects* but also *constructs* the world around us. These aims for a sexual health critical epidemiology outlined above, sow the seeds for an approach whereby critique and improvements to our practice carry the explicit recognition that the knowledge we generate will always reflect – and have the power to challenge or reinforce - moral positions and interpretations.

Non-critical enquiry – in contrast - may be more vulnerable to the production of research findings which constitute and reinforce an impoverished or skewed

understanding of the broader determinants of sexual health (e.g. by failing to account for the impact of zero-hours contracts on ability to access services). This may lead to the development of interventions which are doomed to low impact or failure for the most vulnerable in society (Cassell and Young, 2002), increasing the deleterious effects of health inequalities. E.g. if zero-hours contracts do impact on sexual health service access then interventions to improve access which do not address or account for this, will do little to improve access for those negatively impacted in this way. Non-critical enquiry may also reinforce moral positions which are victim-blaming (Lupton, 1993).

Epidemiological practice will of course vary across subject areas with regard to conventions of method and interpretation, the privileging of different models and ideas, and the assumptions which underlie these. This gives rise to the notion of 'critical epidemiologies' in which each subject area will generate different critiques and responses. Indeed, areas such as child and mental health, may demonstrate methods and approaches that are already closely aligned with the notion of critical epidemiology, such as aspects of life-course epidemiology. However, there is little precedence for critical approaches within studies of sexual health epidemiology, so that it can be difficult to envisage precisely *how* to incorporate criticality into our epidemiological practice. This paper makes tentative steps to re-dress this, by applying the definitions and aims set out above in order to generate some critiques and recommendations for critical epidemiological practice within applied sexual health epidemiology. These are based on the author's observations and experiences working in the field, and are intended to be nascent and illustrative rather than definitive and exhaustive.

CRITIQUES AND RECOMMENDATIONS FOR SEXUAL HEALTH SOCIAL EPIDEMIOLOGY

Following on from the aims and four core features of criticality outlined above, three overarching criticisms of sexual health epidemiological practice emerge:

1. Limited breadth and interpretation of social and psychosocial factors
2. A focus on the 'risky individual' as the cause of adverse sexual health outcomes

3. Operationalisation of public health agendas which privilege and pathologise certain behaviour

These critiques are outlined in the following sub-sections; each carrying a corresponding set of recommendations for critical epidemiological enquiry.

CRITICISM 1: LIMITED BREADTH AND INTERPRETATION OF SOCIAL AND PSYCHOSOCIAL FACTORS

Epidemiologists are often required to identify sub- populations to which standardised interventions – particularly STI screening - should be targeted. This work often centres on constructing and describing homogeneous ‘target’ populations in terms that are behavioural (e.g. Men who have Sex with Men) or socio-demographic (e.g. young people).

In these contexts investigation of socio-demographic variables have traditionally been limited to gender, age, ethnicity and socio-economic status (SES), operationalised with narrow categorisations. In recent years our understanding and measurement of socio-economic status has advanced, with much recent work focusing on neighbourhood measures (Stoltey et al., 2015) (Haley et al., 2017). However evidence suggests that our understanding remains poorly-developed, with large-scale quantitative surveys demonstrating that associations between SES and sexual morbidity (Woodhall et al., 2015; Edelman et al., 2017) are retained in statistical models even after lifestyle variables are included. The unexplained salience of SES in these instances likely reflects the simplicity of SES proxy measures (e.g. housing tenure (Edelman et al., 2017)), and similarly that epidemiology has failed to explore and capture the experiences and mechanisms by which poverty leads to unequal burden of disease. The explanatory potential of observed socio-demographic associations may be overlooked in interpretations of findings – for example putative mechanisms for how poverty impacts on sexual health are rarely offered in quantitative studies. This, combined with scant analysis of social factors, is particularly concerning where studies are not

primarily seeking to socio-demographically define target populations but rather to identify risk factors. In such instances it is likely that convention of practice (such as limited socio-demographic and socio-economic variables) are driving study design and analysis rather than explicit research questions and theory, as should be the case. The author's own work (Edelman et al., 2017) illustrates this point, in which modelling of socio-demographic and psychosocial factors which predict multiple partnerships and condom use is limited by the available dataset and conventions within complex survey methodology.

The limited breadth and interpretation of investigated social and psychosocial factors may also reflect insufficient theory regarding *how* socio-demographic factors might lead to differing outcomes. Models and frameworks grounded in social epidemiology (such as the Biopsychosocial (Engel, 1977) and Martikainen's meso-level schematic 2002) have been important in addressing links between the social world and morbidity. But these models are essentially *formative* – i.e. they are concerned primarily with the categorisation of variables (as psychosocial or psychological for example) and how different categories of variables are positioned in relation to each other. For example Martikainen's model proposes that psychosocial factors act directly on the body and behaviour or via a pathway of psychology and stress. These models offer ubiquitous causal pathways which seek to map out how factors sequentially act on others to eventually bring about a subsequent outcome. This abstraction and focus on form does not lend itself to substantive understandings of *how* the social world acts on lived experience and individual morbidity. Instead it tends to perpetuate the treatment of socio-demographic, socio-economic and other social factors as distal and descriptive 'background' variables which are immutable and therefore of little value to those developing complex interventions.

In contrast, models which are less concerned with ubiquity can *substantively* theorise *how* the social world impact health for particular populations. These may be better mobilised into theoretically and empirically driven interventions by examining the

immediate social world and communities of the individual. Nonetheless the importance of this space has been recognised for some time now and has been investigated more fully using the eco-social model (Krieger, 2001) (Krieger, 2000). Within sexual health specifically not only is there growing study of sexual and social networks, but also the inclusion of variables such as relationship satisfaction and formative life experiences in multivariable statistical modelling of data such as Britain's National Survey of Sexual Attitudes and Lifestyles (Mercer et al., 2014). This latter example illustrates how it is feasible and worthwhile to identify variables which represent the contexts of sexual risk and morbidity, and to incorporate these into multivariable models which seek to explain variance in sexual risk behaviour and morbidity.

Recommendations for addressing limited breadth and interpretation of socio-demographic factors

1. A critical epidemiology for applied sexual health should acknowledge and critique the limitations imposed by a population-health approach; taking care to ensure that social context variables such as area deprivation are included in studies to an adequate degree. It may be beneficial for studies to incorporate and analyse a broader range of social and structural factors (taking care to ensure adequate sample sizes for multivariable analysis). Preliminary literature review and/or qualitative investigation - may be useful in identifying such factors for analysis (e.g. financial resources and future prospects have been shown to be associated with sexual risk in surveys of African-American adolescent women (Raiford et al., 2014)). Literature review and qualitative analysis in developing questionnaire items and response options that better reflect lived experience. Phenomenology and grounded theory would, respectively, be particularly suited to capturing lived experience or identifying putatively causal factors.
2. Symmetrical treatment of social factors in multivariable modelling provides the means to not only 'control' for this kind of data, but also give it primacy while

controlling for investigated psychological and behavioural factors. Statistical techniques which enable causal interpretation of observational data (Winship and Morgan, 1999) might also be applied as part of a critical epidemiology approach to sexual health to enable explanatory interpretations of observed associations. These might also be supported by adjunct qualitative data, and by explicit theorising of substantive links between the social world and sexual health.

3. A critical epidemiology might concern itself with not only formative, but substantive and theoretical constructions that focus on subjective experience. In particular data concerning subjective experience of the sexual and social world, geographical and socio-demographic data should be incorporated and interrogated to a greater degree. Micro-social structural understandings (Latkin and Knowlton, 2005) may be especially applicable, given their focus on the immediate social world and on sexual and social networks. For example, there is tentative quantitative and qualitative evidence for associations between social support and both lower rates of STI acquisition (Gao and Chen, 2011) and greater service access (Edelman et al., 2013). Similarly critical and social psychology may offer important opportunities to enrich the breadth of social and structural factors which we might investigate epidemiologically.

Substantive and theoretical constructions of sexual health may offer a path towards:

- a. Including analysis of factors that incorporate societal norms and power
- b. Disrupting the idea of the individual as a self-contained unit
- c. Developing substantive models that address the 'middle-ground' between socio-demographic and psychological factors (aided by notions of embodiment, of the subjective, the experiential and the psychosocial)
- d. Recognising the lived experience that sits latent behind socio-demographic variables. Thus we might analyse gender recognising that it incorporates power, education as incorporating aspiration, income as incorporating

resources etc. E.g. Krieger (Krieger, 2000b) has asserted that we should investigate race primarily as a social construct through which prejudice and discrimination are enacted.

CRITICISM 2: A FOCUS ON THE 'RISKY INDIVIDUAL' AS THE CAUSE OF ADVERSE SEXUAL HEALTH OUTCOMES

This previous criticism sets out how socio-demographic and other 'population descriptors' are primarily examined as *descriptive*. Conversely, health psychology constructs (such as 'self-efficacy' and risk perception) tend to be interpreted *causally* in sexual health epidemiological studies. This happens even within cross-sectional designs from which causality cannot usually be inferred. Equally longitudinal observational studies examining socio-demographic and psychological variables as predictors of sexual morbidity are likely to interpret the psychological variables as causal but not the socio-demographics. E.g. an observational study which identifies lower risk perception and greater poverty among a certain sub-population known to experience higher morbidity is often followed with evaluation of a complex intervention to 'correct' risk perceptions amongst that group, rather than with a study to examine or address socio-economic factors. Such causal interpretation likely occurs because these constructs were developed within the discipline of health psychology specifically to explain and predict the behaviour of individuals. However, their explanatory power and likely impact at the population (rather than individual) level is questionable and they may embody and reinforce notions of 'risky' and errant individuals in need of correction.

The extent to which other health psychology models can account for lived experience is also questionable, for example the Information-Motivation-Behaviour (IMB) model (Fisher and Fisher, 1992) and the Capability-Opportunity-Motivation model (Michie et al., 2011) which have both been used to explain sexual risk behaviour and use of sexual health services. Evidence suggests that the IMB model leaves much variance in sexual risk unexplained (Mittal et al., 2012) while the latter produces a partial fit with

inductively analysed data when social aspects of service intervention are emphasised (McDonagh et al., 2017). Arguably these models address – in a de-contextualised fashion – some aspects of lived experience. These may instead be extended or replaced by more critical contextual approaches to understanding behaviour, which inductively identify aspects of lived experience using qualitative methods, which can then be explored quantitatively.

It is interesting that social epidemiology has roundly adopted health psychology, because these constructs (which arise from social cognition theory) only incorporate the ‘social’ with regard to norms. Instead they primarily focus on how the individual’s internal psychological world impacts on one’s behaviour. This approach leads to findings which site risk and agency *within* the individual, reinforcing the notion of the individual as the primary agent of change (Krieger, 2014), a key element of contemporary health promotion (Lupton, 1993). Yet the causal interpretation of these observed associations between the psychological and the behavioural is often unwarranted in epidemiological research. These interpretations can be particularly reductive where they fail to account for equity of relationship power and access to resources. This may be particularly problematic in the context of sexual health, where social and sexual inequalities are well-documented (Johnson et al., 2006).

Individual-level analyses arguably foster and perpetuate the focus on the internal experience of the individual. In acknowledgement of the importance of social contexts and agency, analysis at the individual level may be complemented by analyses of dyads, networks and populations. The term ‘sexual encounters’ might be more appropriate than ‘sexual behaviours’. Sexual encounters are necessary ‘intervening variables’ in the pathway to sexual morbidity, so that their nature and frequency is clearly instrumental in that morbidity. The notion of encounters speaks to both quantitative and qualitative dyadic analyses (Mustanski et al., 2014) and to the interpersonal scenarios which form part of sexual script theory, not least because the

latter recognises how such scripts are organised through gender, class and ethnicity (Frith and Kitzinger, 2001).

However the tendency to focus on the individual's causal behaviours rather than on encounters may often represent implicit or poorly explicated theory, rather than explicit adherence to the models described above. A case in point is the tendency to interpret the association between substance use and sexual risk behaviour as directly causal through dis-inhibitory mechanisms, despite evidence suggesting more complex associations (Martino et al., 2006). Interestingly this kind of 'implicitly-theoretical' enquiry is rarely conducted with regard to social and structural factors. This is despite recognition that factors such as access to interventions and core STI rates in communities, will impact on the prevalence and distribution of unintended pregnancy risk, abortion, and STIs (Johnson et al., 2006). Thus we see a disjuncture between broad acknowledgement of the importance of social and structural factors, and the degree to which such factors are given salience within social epidemiological studies. This disjuncture can be understood as the product of collaboration between social epidemiology and traditional health psychology, the dominant approach, and one which has largely gone unquestioned within the field of sexual health.

Recommendations for decreasing focus on the 'risky individual' as the cause of sexual morbidity

1. Firstly, it is important to exercise caution in the interpretation of psychological and behavioural variables, and to counter the reductionism of this focus.
2. Where there are sound reasons (such as investigation of theoretical models) for attributing causality to individual factors such as lifestyle and behaviour, those putative explanatory pathways should be explicated as part of study rationale, and clearly articulated within socio-cultural contexts.

3. It may also be useful to move away from the notion of the 'risky individual' and towards the notion of the 'risky encounter'. This invites us to consider how dynamic and contextual 'sexual risk' is, and to query its existence and nature. It also invites us to consider the subjective experience of sexual encounters, and how power dynamics and social contexts frame those encounters. This recommendation then complements that of more fulsome analysis of social and psychosocial factors suggested earlier in the paper.
4. Social psychology and critical psychology offer strong alternative collaborative opportunities with epidemiology (in place of more mainstream health psychology models) which could focus a critical epidemiology for sexual health more keenly on social and/or structural factors affecting sexual health (e.g. access to services in the context of zero-hour contracts and poverty).

3. ENACTING PUBLIC HEALTH AGENDAS THAT PRIVILEGE OR PATHOLOGISE CERTAIN EXPERIENCES AND BEHAVIOURS

The degree of attention on individuals' behaviours and cognitions discussed in the previous section can be viewed as part of a broader critique in which the body is constructed as a 'mechanized commodity, which is the responsibility of the individual to maintain' (Lupton, 1994). Lupton places this in the context of the social construction of disease or adverse outcomes (Petersen and Lupton, 1996). Similarly there is growing critique of the way in which behaviours deemed undesirable or immoral 'risk factors' by public health are then treated as adverse outcomes (Lupton, 1993). This phenomenon is perhaps perpetuated by the notion of 'risk factors' (which denote factors which are statistically associated with certain outcomes) with 'risk behaviours' (which in the field of sexual health denote behaviours which may lead to those outcomes). Chemsex is arguably one such behaviour which is increasingly constructed as a morally undesirable behaviour which requires ameliorative action in its own right, because of known associations with poor sexual health outcomes. Unplanned pregnancy in contrast is a clear example of a socially-constructed - indeed public

health-constructed – adverse *outcome* (rather than behaviour) which is discussed below in greater depth for illustrative purposes.

Firstly it is arguable that ‘unplanned pregnancy’ is privileged over ‘unintended’, ‘unwanted’ or ‘mistimed’ pregnancy in epidemiological studies, despite a broader literature recognising these differing concepts. The preference for focusing on pregnancy planning (as a behavioural concept) likely reflects how epidemiology has developed as a means of addressing a contemporary public health agenda concerned with reducing *behavioural* harms rather than improving the *circumstances* in which populations live. As a behavioural measure it is also more simply defined and therefore easy to operationalise in the derivation of population estimates. The value of investigating any of these pregnancy-related constructs is questioned by Macleod (Macleod, 2016) who notes that public health concern in this domain arises from the likelihood of adverse outcomes, for which there is no clear causal association. She (Macleod, 2016) also notes that these concepts all ‘fail to shift the focus in any substantive way from the individual woman and her desires, wants, plans, decisions and intentions’; thereby placing all responsibility for reproduction at her feet.

Studies often use quantitative measures which enable categorisation of pregnancies as unplanned, planned, or somewhere in between (such as the London Measure of Unplanned Pregnancy (Barrett et al., 2004)). Interestingly studies sometimes aggregate ambivalent pregnancies with those categorised as unplanned or unintended or – similarly - define all those ‘at risk’ as those not actively seeking pregnancy or sterilised (Moreau and Bohet, 2016). This operationalises a particular public health agenda, which is to target contraception to *all* women who are not actively seeking to get pregnant. This agenda arguably ‘pathologizes’ non-use of contraception by women in this category, a position which underpins and is reinforced by contemporary epidemiology with little, if any, dissent.

Recommendations for noticing and potentially challenging public health agendas which pathologize and privilege certain experiences, reinforced by epidemiology

1. The Public Health agendas which underpin much epidemiological enquiry should always be explicitly acknowledged and queried as part of epidemiological study design processes, in order to notice and challenge reductive or moralising positions, rather than reinforcing and perpetuating them
2. The ways in which we construct and operationalise Public Health concerns such as unplanned pregnancy should be informed by an explicitly critical approach. In particular critical and social psychology may be useful disciplines from which to counteract individualistic, behavioural constructions of risk. For example:
 - a. Macleod's notion of 'unsupportable' pregnancy (Macleod, 2016) may be a viable alternative to the concept of unplanned pregnancy, allowing 'for an analysis of the intersection of individual cognitions, emotions and behaviour with micro-level interactive spaces (e.g. partners, family ,healthcare service providers) and macro-level issues (e.g. policy, cultural patterns)'
 - b. Where concepts of unplanned or unintended pregnancy are adhered to, ambivalence should be analysed separately in order to explicitly recognise and reframe non-contraception use by those ambivalent about pregnancy as a valid choice, and the public health drive for use of contraception (especially Long Acting Reversible Contraception) should be explicitly stated as a reason for its analysis

CONCLUSION

'Criticality' can be viewed as a commitment to approaching (research) practice in a way which privileges certain concerns with a view to enabling social change grounded in the redressing inequalities. As epidemiology represents a particular set of methods applied to a particular topic of interest, so it is possible to envisage a critical epidemiology for sexual health (and other topics) which remains substantively focused on the causes and distribution of disease using quantitative methods. Critical epidemiology may improve epidemiological practice at various stages in the research process; impacting on the focus, nature, analysis and interpretation of investigations.

In particular it opens the door to integration with critical and social psychological perspectives rather than with the models of 'traditional' health psychology.

This paper offers nascent steps in the development of a critical epidemiology for applied sexual health, sharing some of the author's critiques of conventional epidemiological practice but also offering some specific recommendations for critical epidemiology practice that arise from those critiques. In this way, the paper not only critiques contemporary epidemiological practice in sexual health, but also specifically illustrates how criticality might be enacted and integrated within conventional epidemiological studies. Many of these recommendations, such as symmetrical treatment of covariates, are not novel in themselves but are nonetheless congruent with critical epidemiological practice in which we should seek to be 'Approaching knowledge as a social and political force' (Siedman, 2012). Equally, the notion of 'feminist epidemiology' has been reported (Inhorn and Whittle, 2001) and may constitute a type of critical epidemiology. Finally, the notion of critical epidemiology for sexual health, as envisaged in this paper, is conducive with calls from the wider academic community for epidemiology to move away from a substantively atheoretical position, towards one which actively seeks to theorise (Broadbent, 2011). The ideas set out in this paper may also be congruent with many set out by feminist quantitative enquiry, as another specific area of critical investigation (Reinharz and Davidman, 1992), and with those of critical psychology which is offered as an alternative disciplinary partner to epidemiology (in place of traditional health psychology). Measurable salutogenic concepts may also be viewed as conducive with critical epidemiology, particularly those of socio-economic marginalisation and the social dimensions of the Salutogenic Wellness Promotion Scale (Becker et al., 2010).

In essence, the social world and its influence on the health of populations and individuals is a shared key concern of conventional social epidemiology and of criticality. Although the analytical techniques and interpretation of social epidemiology are not inherently uncritical *because* they are quantitative, nonetheless we work

within the constraints of designs which are limited in depth and within the interests of public health. Therefore conventions have developed which might be unproductive and implicitly moral in their approach to social and 'structural' factors. Similarly, the adoption of many health psychology constructs may reflect the ease with which their measurable, individualistic nature fits with conventional quantitative designs. It is also arguable that structural constraints from funders, disciplines and publishers can negatively impact research topics and methodological innovation.

The treatment and the interpretation of social and structural factors – particularly gender, sexuality, ethnicity and poverty - are not only points of contention but also of reconciliation between critical approaches and social epidemiology. Certainly our lived experience, and the social contexts in which experience takes place, can and should form an essential part of our epidemiological understanding of sexual health, not least because power and structural factors must influence and mitigate our health. By recognising that lived experiences sit behind socio-demographic variables, multivariable regression and stratification offers an opportunity to look quantitatively at intersectionality, an idea proposed elsewhere (Bauer, 2014; Bowleg, 2012). In fact studies of this nature, particularly the body of evidence examining ethnicity, education and STI diagnosis (Annang et al., 2010), already does this in all but name.

Critical epidemiology invites us to revisit the earliest uses of epidemiology in informing societal change (e.g. access to clean water and healthcare) (Rosenberg, 1966). In contrast, contemporary epidemiology's focus on 'causal' individual thoughts and behaviours acts to perpetuate a political individualism in which the structure of society is rendered a benign environment in which errant individuals freely choose unhelpful thinking and behaviours. These ideas chime with critiques of 'lifestyle risk' by Lupton (Lupton, 1993), with the interests of social and critical psychology and with many of the points raised by Krieger (Krieger, 2000a). Her generic critiques focus on the absence of extant and explicit theory in social epidemiology. In contrast, this paper takes a pragmatic focus on identifying concrete steps to alter the way epidemiological

practice can be improved regarding the selection, analysis and interpretation of data in sexual health epidemiology specifically. Not only does Krieger argue that a focus on individual cognition and behaviour leads to a moral position of victim-blaming, but also that our reluctance to assign social associations as 'casual' – pointing out that 'Grappling with notions of causation....raises.... issues of accountability and agency' (Krieger, 2001).

Equally critical epidemiology may offer an opportunity to re-visit and re-frame the notion of supportive factors (such as social support) which were explored in early social epidemiology. This in turn invites us to critique the treatment of 'risky behaviours' as chosen acts which are positioned in reference to 'harmless' and neutral behaviours/individuals (Blastland and Spiegelhalter, 2013) as the base/reference group in quantitative analysis. Instead we might honour the active choices required in health-seeking sexual behaviour and perhaps position 'risky behaviour' as the reference value in quantitative analyses.

The essential difference between critical epidemiology and social epidemiology might then be said to lie in the following. Firstly, an acknowledgement that epidemiology is *implicitly* theoretical in its interests and often adheres to political rhetoric. Secondly, in a will to respond to that rhetoric with theory-making, analyses and interpretations developed from a critical and moral position. In this sense critical epidemiology chimes with both a wide body of literature addressing the regulation of the body by public systems (Petersen and Lupton, 1996), and with specific critiques such as the 'psychiatrization' of poverty (Mills, 2015). A key component of critical epidemiology may then be its collaboration with critical psychology and critical sociology in place of the traditional health psychology critiqued in this paper.

This paper and the recommendations within it are based on the author's reflections and experience of epidemiological practice, which they have encountered while working in sexual health research. As such this paper will have missed important critiques outside of the author's experiences and knowledge-base, and equally will have identified difficulties which may not be pervasive in all areas of sexual health

research and/or in other disciplines. Nonetheless, it is hoped that this paper may offer tentative steps towards the development of a critical epidemiology for sexual health. The recommendations put forward in this paper are not intended as essential components of critical epidemiology practice, rather they serve to illustrate how tenets of criticality might be applied in order to realise that practice.

To practice critical epidemiology is to notice and engage with our role as both reflectors and constructors of knowledge, the social world, and the policies and morals which influence that world. As well as addressing some of the broader critiques of contemporary social epidemiological practice, critical epidemiology has the potential to improve our understanding of specific health issues, and to re-politicise epidemiology as a moral force for good. Notably, the nature and reasons for socio-economic disparities in sexual health remain poorly understood (Sheringham et al., 2013). Critical epidemiology may provide a useful approach for improving our understanding of these associations, and for countering the focus on the individual's behaviour and beliefs which dominate sexual health epidemiology. For this to be realised, the development of critical epidemiology must be methodologically sound, enriching in knowledge and emancipatory in intent.

COMPLIANCE WITH ETHICAL STANDARDS

This theoretical article does not present data from studies with human participants or animals performed by the author and therefore does not require ethical approval.

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DECLARATION OF CONFLICTS OF INTEREST

None declared

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